

Home garden pesticide uses and hazards

A quick reference for Master Gardeners by Oregon State University Extension Service and Metro

Pesticides should only be used when needed, when risks to non-target organisms and habitats have been carefully considered, and when diligent attention will be given to following all label directions and other applicable laws.

Follow Integrated Pest Management (IPM) protocol

1. **Look for patterns** to determine whether damage is uniform or random (plant part, whole plant, population, community).
 - a. Uniform damage on many plants or an individual plant usually indicates abiotic (nonliving) factors:
 - Mechanical:** damage from equipment, animals, children, vandalism, etc.
 - Physical:** improper drainage and/or soil porosity, excessive heat or cold, changes in light intensity, etc.
 - Chemical:** herbicide application drift, toxic chemicals, nutrient deficiencies/toxicities.
 - b. Random damage on one or only a few plants often indicates biotic (living) factors:
 - Pests** such as insects, slugs, mites, birds and/or rodents.
 - Pathogens** such as bacteria, fungi and/or viruses.
2. **Formulate a tentative diagnosis** based on your research using credible sources.
 - a. Use OSU Master Gardener *Sustainable Gardening* handbook, Pacific Northwest Management handbooks, MG clinic reference books and www.metromastergardeners.org.
3. **Determine possible controls** in this order:
 - First – Cultural and physical
 - Second – Biological
 - Last – Chemical (use the charts below to determine and communicate relative hazards.)
5. **Develop an action threshold** based on needs of client, and benefits and risks of options.
6. **Monitor and evaluate** effects of control interventions.

Hazard levels of US EPA-registered pesticides

All hazard ratings based on registered uses. Failure to follow label directions is illegal and will likely increase hazards.

FUNGICIDES

Cultural, physical and biological controls are typically least hazardous; see PNW Disease Management Handbook.							
Active ingredient	Human toxicity hazard	Pets and wildlife hazard	Bee toxicity hazard	Aquatic life hazard	Water pollution hazard	Notes on uses	Organic status
<i>Bacillus subtilis</i>	L	L	L	L	L	Biological fungicide with moderate efficacy if applied early in disease cycle; example: Serenade®.	organic
fixed copper (copper compounds)	L	M	L	H	L	Used as dormant season spray; effective for wide range of plant diseases; example Kop-R-Spray®.	some organic
jojoba oil	L	?	L	H	?	Botanical product; used as an horticultural oil.	organic
neem oil	L	L	L	M	?	Botanical product; used as an horticulture oil; effective for powdery mildews; also has insecticidal properties; contains azadirachtin.	organic
potassium bicarbonate	L	L	L	L	M	Provides minor control of powdery mildews if applied early in disease cycle; example: Monterey Bi-Carb®.	organic
sulfur	L	L	L	L	L	Used for powdery mildew and other plant diseases when temperatures are between 65-85°F; use within 10 days of an oil spray may cause plant damage; may stunt shoots.	organic
lime sulfur	L	M	L	H	H	Effective dormant spray for apple scab and other diseases; can cause severe eye damage; use eye protection.	organic
triforine	L	M	L	M	H	Effective fungicide for use with powdery mildews, scab, rust and other diseases; example: Ortho® RosePride® Funginex.	
captan	H	H	L	H	L	Controls a wide range of fungal diseases; example Hi-Yield® Fungicide 50 WP.	
chlorothalonil	H	H	L	H	L	Good protectant fungicide; controls many diseases on many crops; examples: Bonide® Fung-onil™ Multi-purpose Fungicide and Daconil® Weather Stik®.	
myclobutanil	H	M	L	M	H	Effective fungicide for home market; example Spectracide® Immunox®.	
propiconazole	H	M	L	H	M	Has systemic and eradicative properties; example Ferti-Lome® Liquid Systemic Fungicide.	
tebuconazole	H	H	L	H	M	Very effective fungicide for a variety of plant diseases; example: Bayer™ Advanced Disease Control.	
thiophanate-methyl-based	H	H	L	H	M	Systemic fungicide with protectant properties; example Ferti-Lome® Halt™ Systemic.	

HERBICIDES

Cultural, physical and biological controls are typically least hazardous; see PNW Weed Management Handbook (section T only).							
Active ingredient	Human toxicity hazard	Pets and wildlife hazard	Bee toxicity hazard	Aquatic life hazard	Water pollution hazard	Notes on uses	Organic status
ammonium salt of fatty acids	L	L	L	H	L	Contact herbicide, nonselective.	organic
potassium salt of fatty acids	L	L	L	H	L	Contact herbicide, nonselective.	organic
dicamba	M	M	L	L	H	Post-emergent herbicide selective for broadleaf plants; can damage trees and shrubs growing in lawn.	
triclopyr BEE (butoxyethyl ester)	M	H	L	M	H	Controls broadleaf and woody plants; applied to foliage or cut stems; ester formulations are volatile above 60°F.	
glyphosate	H	M	L	M	L	Systemic, broad-spectrum herbicide; use when plants are actively growing.	
2,4-D	H	M	L	L	H	Systemic post-emergent herbicide selective for broadleaf plants.	
dichlobenil	H	H	L	M	H	Pre-emergent herbicide for perennial beds only.	
diquat dibromide	H	H	L	H	L	Contact herbicide, non selective.	
fluazifop-p-butyl	H	L	L	H	H	Post-emergent herbicide for annual and some perennial grasses among broadleaf plants; does not control annual blue grass.	
MCPA (acid, dimehtylamine salt and sodium salt)	H	M	L	L	H	Post-emergent herbicide selective for broadleaf plants.	
MCPA 2-ethylhexyl ester	H	M	L	H	H	Post-emergent herbicide selective for broadleaf plants.	
MCPP (mecoprop-p)	L	H	L	L	H	Post-emergent herbicide selective for broadleaf plants.	
oryzalin	H	M	L	M	H	Pre-emergent herbicide for annual and perennial beds.	
oxyfluorfen	H	M	L	H	L	Contact herbicide, nonselective; added to broad spectrum formulations to hasten foliage death.	
sethoxydim	L	H	L	M	H	Post-emergent herbicide for annual and some perennial grasses among broadleaf plants; does not control annual blue grass.	
trifluralin	H	L	L	H	L	Pre-emergent herbicide for annual and perennial beds.	

INSECTICIDES

Cultural, physical and biological controls are typically least hazardous; see PNW Insect Management Handbook.							
Active ingredient	Human toxicity hazard	Pets and wildlife hazard	Bee toxicity hazard	Aquatic life hazard	Water pollution hazard	Notes on uses	Organic status
azadirachtin	L	M	H	M	H	Botanical product derived from neem oil; acts as stomach poison; broad spectrum; also used as horticultural oil for disease control.	organic
<i>Bacillus thuringiensis</i> (Bt)	L	M	L	M	L	Microbial stomach poison for leaf-feeding insects; effective against many caterpillars if used early in pest cycle; requires repeat application.	organic
<i>Beauveria bassiana</i>	L	L	M	L	L	Microbial contact insecticide; broad spectrum; requires repeat application.	organic
capsaicin	L	M	H	M	M	Repellent derived from botanical source. Can be an extreme irritant to eyes and mucous membranes.	organic
insecticidal soap (potassium salt of fatty acids)	L	L	L	H	L	Contact insecticide useful for soft-bodied insects such as aphids and scale; requires repeat application.	organic
jojoba oil	L	?	L	H	?	Horticultural oil used to smother soft-bodied insects.	organic
kaolin clay	L	?	L	?	L	Mined material acts as physical barrier and as a repellent creating an unsuitable surface for feeding and egg-laying.	organic
lambda-cyhalothrin	L	H	H	H	L	Pyrethroid; broad-spectrum.	
neem oil	L	L	L	M	?	Horticultural oil used to smother soft-bodied insects with additional stomach poison attributes per azadirachtin.	organic
spinosad	L	L	H	M	L	Soil bacteria acts as stomach poison; broad-spectrum on plant-feeding insects; used also as molluscicide.	organic
sulfur	L	L	L	L	L	Used for control of mites; use dust mask if applied as powder; can damage plants if applied in hot weather.	organic
lime sulfur	L	M	L	H	H	Use on dormant plants for scale; combine with dormant oil for mite and mealybug control; don't apply to rhododendron, euonymus, or viburnum; has fungicidal properties; caustic, use eye protection.	organic
petroleum oil (horticultural oil)	M	L	L	M	L	Derived from petroleum distillate; follow directions carefully to avoid plant damage; often combined with lime or lime sulfur.	

Active ingredient	Human toxicity hazard	Pets and wildlife hazard	Bee toxicity hazard	Aquatic life hazard	Water pollution hazard	Notes on uses	Organic status
acetamiprid	M	H	H	H	H	Neonicotinoid; contact and systemic; used for sucking insects.	
acephate	H	H	H	H	L	Organophosphate; systemic and contact; not for use in food crops.	
bifenthrin	H	M	H	H	L	Pyrethroid; broad-spectrum.	
carbaryl	H	M	H	H	H	Carbamate; broad-spectrum; can cause spider mite outbreaks.	
cyfluthrin	H	M	H	H	L	Pyrethroid; broad-spectrum; contact.	
esfenvalerate	H	H	H	H	L	Pyrethroid; broad-spectrum; contact.	
imidacloprid	L	H	H	H	H	Neonicotinoid; systemic and contact; broad-spectrum.	
malathion	H	M	H	H	M	Organophosphate; broad-spectrum; general-use registrations are being phased out.	
permethrin	H	L	H	H	L	Pyrethroid; contact.	
pyrethrins	H	M	H	H	L	Botanical; contact; broad-spectrum.	organic

MOLLUSCIDES

Cultural, physical and biological controls are typically least hazardous; see PNW Insect Management Handbook.							
iron phosphate	L	?	L	L	L	Effective bait for slug control; requires repeat application.	organic
metaldehyde	H	H	L	M	H	Very effective control for slugs and snails, but poisonous to vertebrates.	

MOSSICIDES

Cultural, physical and biological controls are typically least hazardous; see PNW Disease Mangement Handbook.							
iron-based material plus fertilizer (ferrous sulfate and ferric sulfate)	L	M	?	M	L	Example: Fred Meyer® Turf King™ Moss Control plus lawn food, Lilly Miller® Ultragreen Moss Control Lawn Food; Lilly Miller® Moss Out™ Lawn Granules, Fortify Moss Control Granules.	

Understanding the hazard ratings

The ratings in this document are based on the pesticide active ingredient review process developed and used by Thurston County Environmental Health Division, and adapted by Grow Smart, Grow Safe®, a partnership with Metro, Thurston County and King County Washington. The review criteria is consistent for each chemical and all data used is referenced at http://www.co.thurston.wa.us/health/ehipm/ipm_homeownr.html. Columns in the tables above show hazard ratings that represent specific groups of concerns, and assessment criteria. Colors indicate overall hazard rankings. The active ingredients are alphabetically arranged within each overall hazard ranking for each pest category.

Overall hazard ranking definitions

All active ingredients reviewed in this document are EPA-registered pesticides.

Lowest hazard		Active ingredient is low in toxicity and environmental hazard. Referenced studies used in the review indicate that products within this category contain active ingredients that pass the Thurston County review criteria.
Moderate hazard		Active ingredient is one or more of the following: persistent with a high potential to move off the site of application (water pollution hazard); and/or exposure to the active ingredient after application approaches the EPA's level of concern; and/or different products with the same active ingredient have potential exposures ranging from lowest to highest hazard (based on EPA-registered application methods). This is Thurston County's "conditional" ranking.
Highest hazard		Active ingredient is one or more of the following: known to cause a significant animal toxicity hazard (known or possible carcinogen, chemical mutagen, reproductive or developmental toxicant); and/or exposure to the active ingredient after application is close to or exceeds the EPA's level of concern to humans, animals, or fish; and/or is persistent with the potential to bioaccumulate.

Human toxicity hazard

Ratings are based on a chemical's potential to cause carcinogenicity, mutagenicity, reproductive toxicity, developmental toxicity or endocrine disruption. Ratings also include an assessment of risk from short- or long-term exposures to humans from labeled uses.

Pets and wildlife hazard

Ratings are based on risk of toxicity to pets and wildlife from potential exposures following labeled uses.

Aquatic life hazard

Ratings are based on the potential to cause toxicity from short- or long-term exposures to fish or other aquatic organisms resulting from labeled uses.

Water pollution hazard

Ratings are based on the combined hazards of mobility and persistence of an active ingredient.

Mobility: the potential for an active ingredient to move off the site of application with rain or irrigation water.

Persistence: how long a pesticide chemical (or its metabolites) remains in the environment. Persistent chemicals sometimes accumulate in soil, water, or animal and fish tissue (e.g. DDT, chlorfenapyr, and difethialone).

Hazard ratings

Low hazard	L		The active ingredient is rated low in hazard for that category.
Moderate hazard	M		The active ingredient is rated moderate in hazard for that category.
High hazard	H		The active ingredient is rated high in hazard for that category.
Not enough data	?		Useful data is not available.

Organic status

Material is available in formulations allowable under the US National Organic Program. Check the Organic Materials Review Institute (OMRI) or the Washington State Department of Agriculture (WSDA) for information about specific products.

EPA minimum-risk pesticides: OSU Master Gardener program does not generally recommend

US Environmental Protection Agency (EPA) "minimum-risk pesticides" (satisfying section 25(b) of the Federal Insecticide, Fungicide, and Rodenticide Act) have

Source references

Grow Smart, Grow Safe: www.growsmartgrowsafe.org

Thurston County Environmental Health IPM Program: www.co.thurston.wa.us/health/ehipm/ipm_homeownr.html

PNW Disease Mangement Handbook: <http://plant-disease.ippc.orst.edu/>

PNW Weed Mangement Handbook: <http://pnwhandbooks.org/weed/>

PNW Insect Mangement Handbook: <http://insects.ippc.orst.edu/pnw/insects>

University of California IPM: <http://www.ipm.ucdavis.edu/PMG/menu.homegarden.html>

Hortsense from WSU: <http://pep.wsu.edu/hortsense/>

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